

Creative Laboratory

Scale #2: hardware



The Timetable

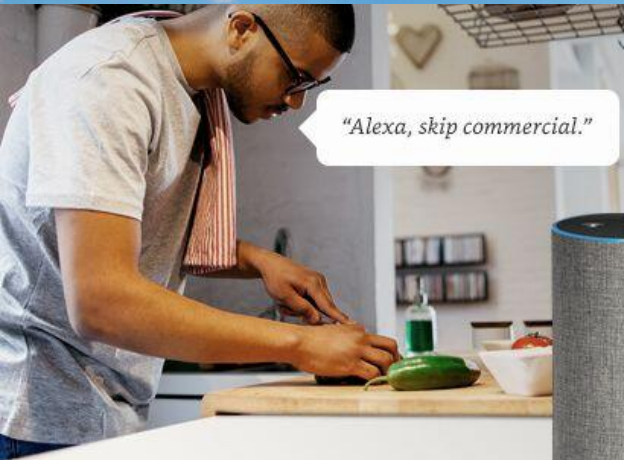
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- Wed 13th Mar: 11.00-13.00: Tutorials



Today

- Flat ontology and scales of objects in Voice
- Hardware #1: AWS servers
- Hardware #2: Cables and infrastructure
- Hardware #3: Echo teardown





2016

\$297.8B

amazon

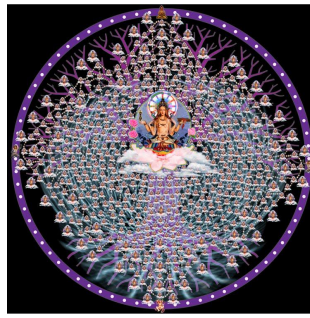
Walmart

TARGET

BUY
macy's

KOH'S NORDSTROM

JCPen



Software/Protocols



Hardware



Humans/Culture



Structure

Flat Ontology

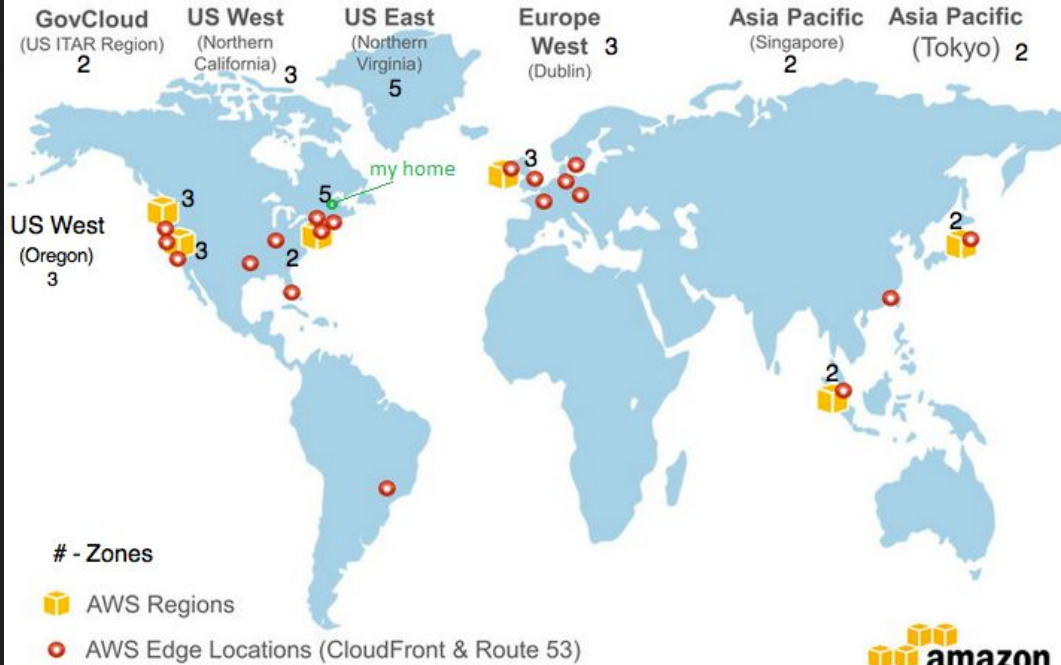


Hardware #1:

Amazon Web Services (AWS)



Global Amazon Web Services (AWS) Infrastructure





PERIMETER LAYER

AWS data center physical security begins at the Perimeter Layer. This layer includes a number of security features depending on the location, such as security guards, fencing, security feeds, intrusion detection technology, and other security measures.

EXPLORE »



INFRASTRUCTURE LAYER

The Infrastructure Layer is the data center building and the equipment and systems that keep it running. Components like back-up power equipment, the HVAC system, and fire suppression equipment are all part of the Infrastructure Layer.

EXPLORE »



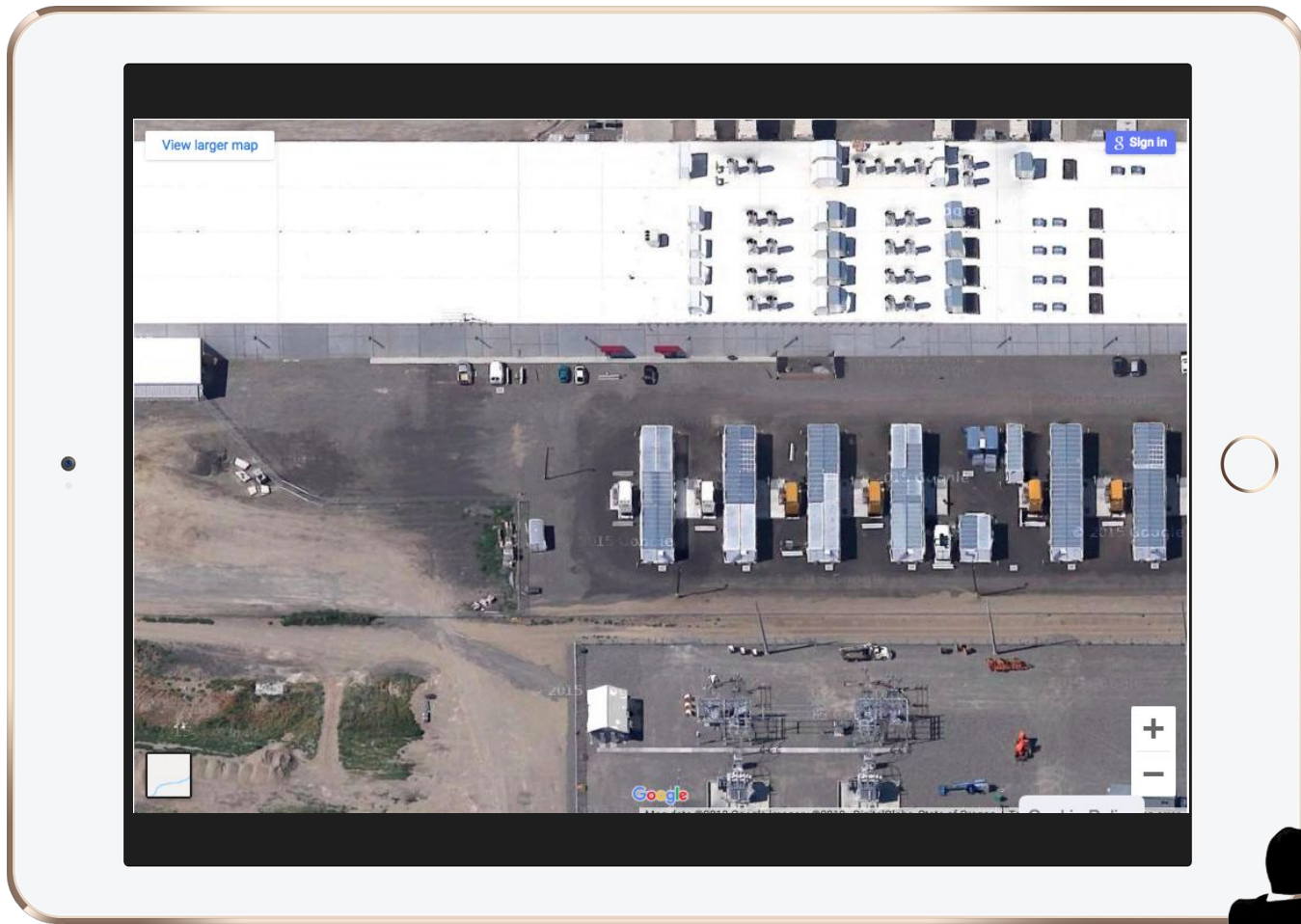
DATA LAYER

The Data Layer is the most critical point of protection because it is the only area that holds customer data. Protection begins by restricting access and maintaining a separation of privilege for each layer. In addition, we deploy threat detection devices and system protocols, further safeguarding this layer.



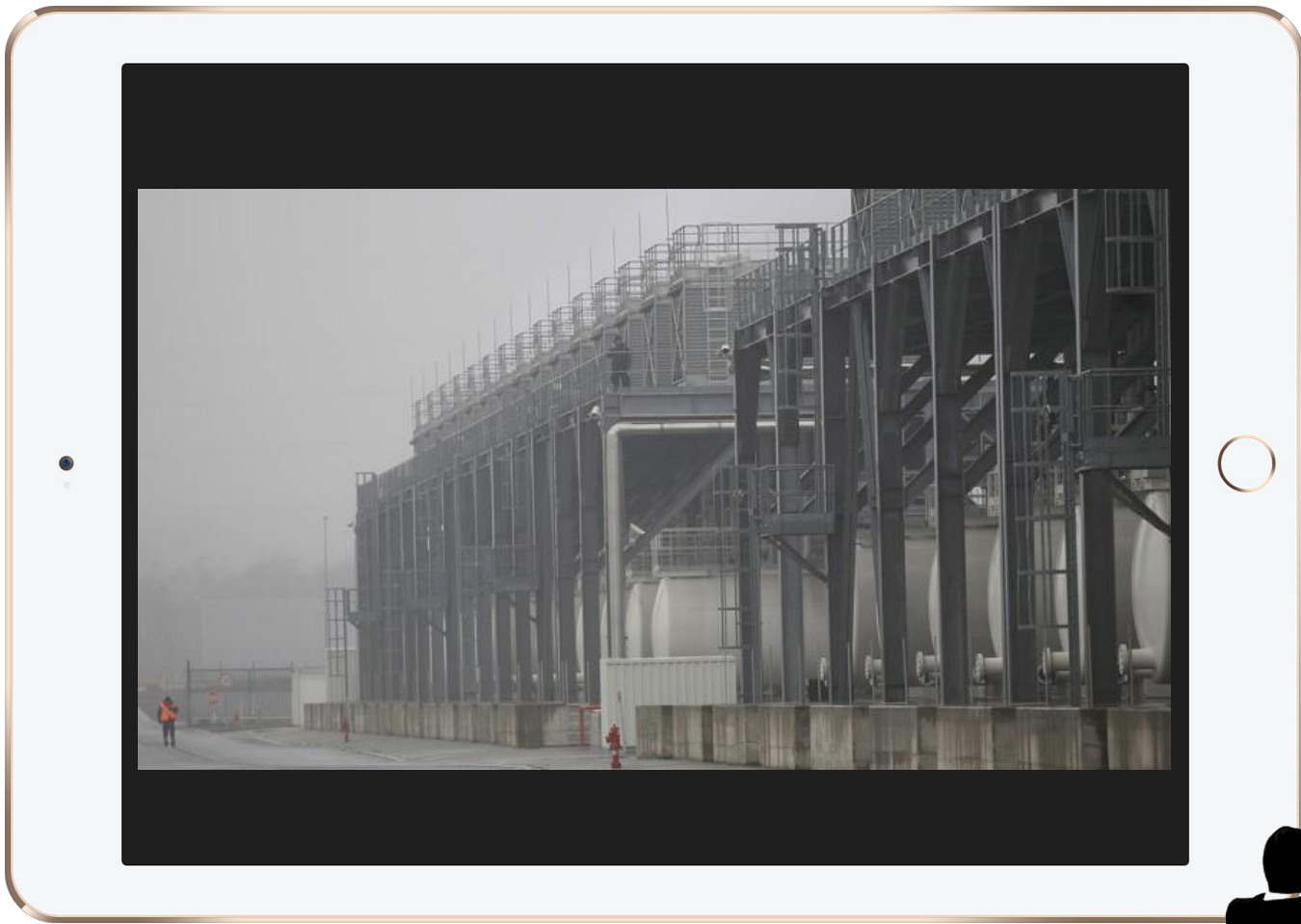
ENVIRONMENTAL LAYER

The Environmental Layer is dedicated to environmental considerations from site selection and construction to operations and sustainability. AWS carefully chooses our data center locations to mitigate environmental risk, such as flooding, extreme weather, and seismic activity.



<https://virtualglobetrotting.com/map/aws-amazon-web-services-server-farm/view/google/>

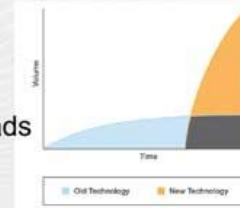




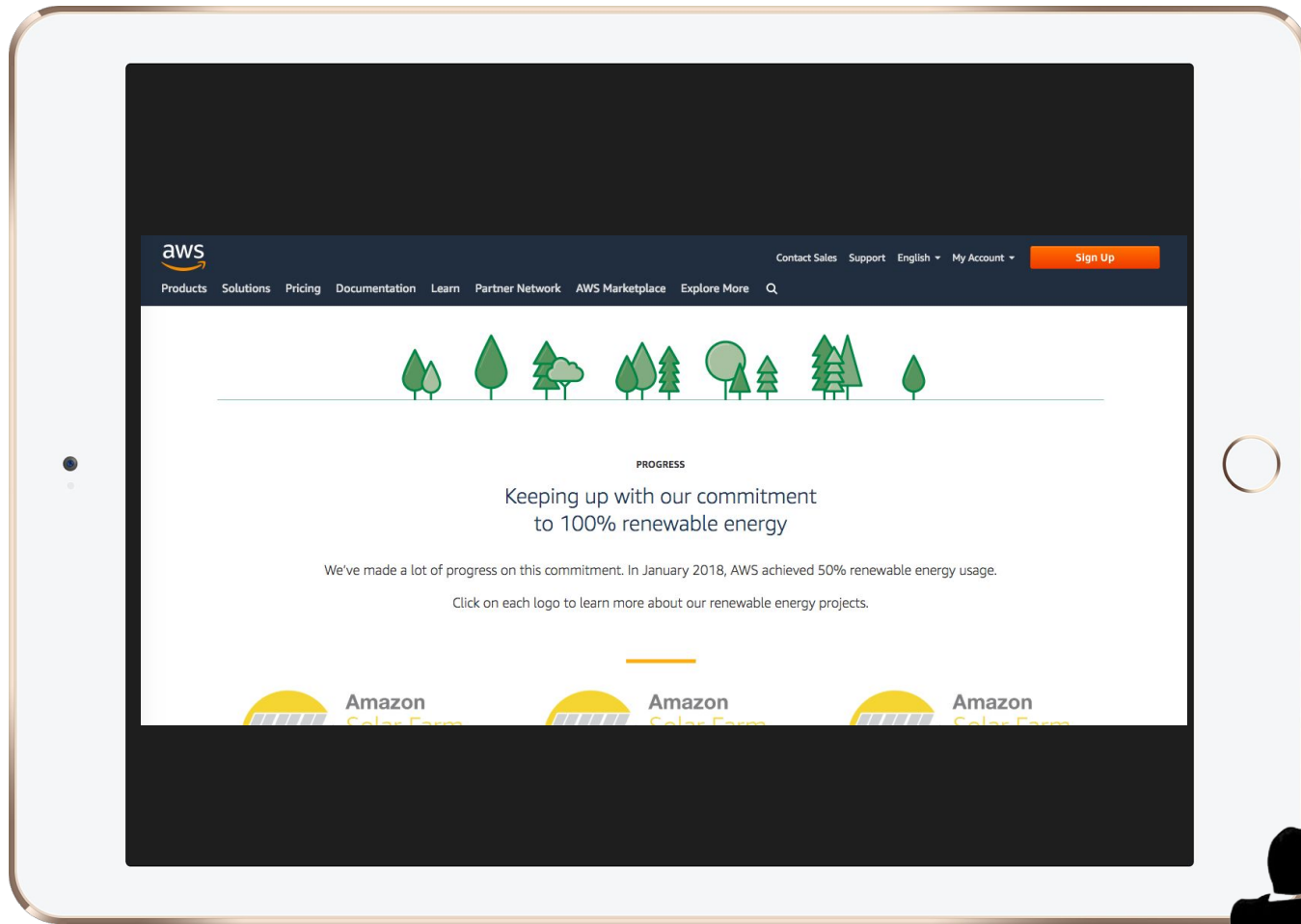


AWS Custom Server & Storage Designs

- OEM server ecosystem:
 - Very general designs able to run wide variety of workloads
 - Vast, expensive, world-wide distribution network
- AWS custom servers & storage:
 - Specialized servers optimized for a specific workload
 - Move hot s/w kernels to hardware implementations
 - Custom Intel procs beyond commercially available clock rates
 - DCs, servers, networking, storage designed to integrated specs



Example Storage Rack
• 864 disks, 2,350lb



<https://aws.amazon.com/about-aws/sustainability/>





Cloud computing market leader Amazon Web Services (AWS) took some important steps in the past year, including promising leadership in supporting clean energy policy. But given AWS's continued lack of transparency and its rapid growth in Virginia and other markets largely served by **dirty energy**, it remains unclear whether the AWS cloud is actually on a path to becoming renewably powered.

One of the single biggest obstacles to sector transparency is Amazon Web Services (AWS). The world's biggest cloud computer company remains almost completely **non-transparent about the energy footprint of its massive operations**. Among the global cloud providers, only AWS still refuses to make public basic details on the energy performance and environmental impact associated with its operations.

<http://www.clickclean.org/uk/en/>

Hardware #2:

the Tubes





VIDEO

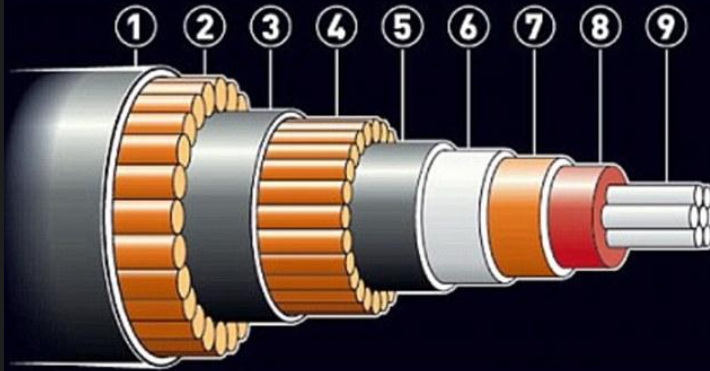
Revealed: how reporter strolled into UK's 'secure' data-cable sites

Landing stations for transatlantic cables are key to our infrastructure, but lax security could leave them open to attack

Poggrund



INSIDE APOLLO'S HIGH-SPEED CABLE

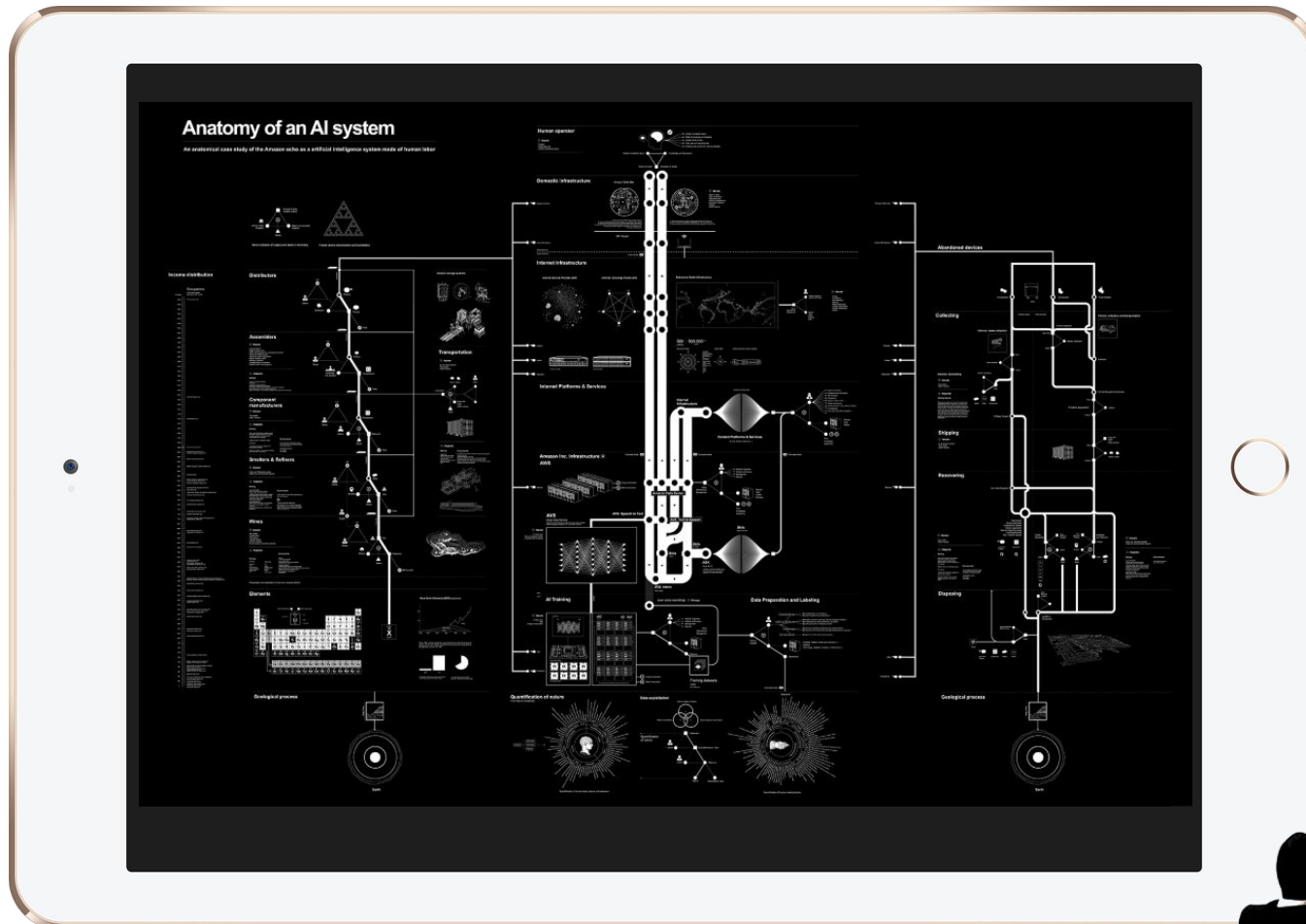


- 1** Polyethylene cover
- 2 & 4** Stranded steel wires
- 3 & 5** Tar-soaked nylon yarn
- 6** Polycarbonate insulator
- 7** Copper sheath
- 8** Protective core
- 9** Optical fibres

Hardware #3:

the Echo





RAW MATERIALS ACQUISITION

RAW MATERIALS

Essentially, the Echo Dot is a combination of two circuit boards consisting of various silicon chips, a metal base plate, a speaker, and an outer plastic housing. The electronics use a variety of metals including quartzite, coal, phosphorus, silicon oxide, copper, gold, silver, iron, aluminum, gallium, indium, antimony, and arsenic. Other raw materials include latex for rubber, and coal, gas, and oil to make plastic polymers.

EMBODIED ENERGY

The materials needed to create an Amazon Echo Dot are rare metals that take a significant amount of energy to mine, and then even more energy to purify. In addition, these metals need to be formed into small pieces before being manufactured which means they must also be shipped all over the world through various transport systems - thereby using a large amount of energy.

MANUFACTURING PROCESSING + FORMULATION

RAW MATERIALS

Silicon wafers have to undergo various chemical baths so that the silicon chips will not be contaminated, which means that various materials that are used in the manufacturing stage do not make up any part of the Echo Dot as a finished product. These include deionized water, hydrogen chloride, hydrogen peroxide, and epoxy resin. Different electronic parts are also soldered together, which consists of tin and lead.

EMBODIED ENERGY

A majority of the embodied energy of the Echo Dot can be attributed to the manufacturing process. An extensive amount of energy is used at this stage because the production of the silicon chips and circuit boards is extremely precise, down to the atomic level. A great deal of energy is also necessary to attain silicon at a 99.999% purity to be used in the silicon chips.

DISTRIBUTION + TRANSPORTATION

RAW MATERIALS

Fossil fuels like coal and crude oil are used to transport different raw materials and components all across the world to different factories for manufacturing, ultimately to be transported to the consumer. The final product also has to be packaged, using paper and cardboard, which originate from trees.

EMBODIED ENERGY

Energy from fossil fuels is used to transport different parts across the world, meaning that Amazon is using more energy than they should just to transport the parts and Amazon Echo Dots to different factories and consumers.

USE RE-USE + MAINTENANCE

RAW MATERIALS

The Echo Dot doesn't require any maintenance in its lifetime. In order to function, the Echo Dot requires electricity, which is converted from fossil fuels like natural gas and coal.

EMBODIED ENERGY

The Echo Dot consumes a minimal amount of energy in day to day use compared to the processes used to create the Echo Dot, using an average of just three watts, equating to just 26.28 kWh of energy per year.



RECYCLING

RAW MATERIALS

Most components in the Echo Dot cannot be recycled. All the critical metals besides gold and silver cannot be recycled. This means that 100% of the indium, gallium, and antimony in the Echo Dot, which the world is quickly expelling the supply of, cannot be recycled and reused.

EMBODIED ENERGY

Recycling different metals in the Echo Dot is vital to preserving these rare earth metals that humans are consuming, even if it takes a considerable amount of energy to recycle. Still, there are rare earth metals that we simply cannot recycle.

WASTE MANAGEMENT

RAW MATERIALS

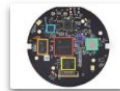
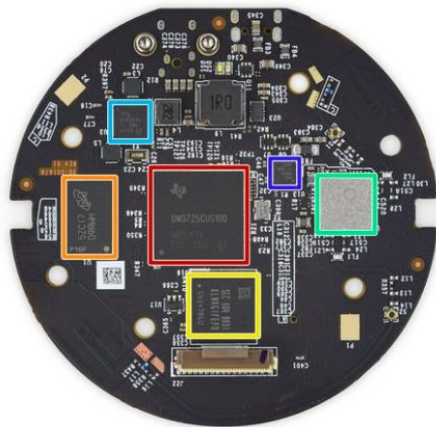
Everything that cannot be salvaged and recycled is transported to landfill, which requires natural gas to fuel. Some of these materials can be harmful to the environment like toxic metals or plastics. The majority of the Echo Dot consists of these materials.

EMBODIED ENERGY

Most of the Echo Dot cannot be recycled, so the rest of the materials are thrown away, which uses a small amount of energy to transport the electronic waste to landfills. In addition, most of the rare metals that could be reused are just thrown away rather than mined from the waste which is a waste of the energy spent during the manufacturing stage.

AMAZON ECHO DOT

Life Cycle of an Amazon Echo Dot
Fall 2018 SAS 043
Ryan Lazzareschi & Sarika Kumar



- Chips on one side, ports on the other. Here's what this motherboard is packing:
 - Texas Instruments [DM3725](#) Digital Media Processor
 - Micron [MT46H64M32LFBQ](#) 256 MB (16 Meg x 32 x 4 Banks) LPDDR SDRAM
 - Samsung [KLM4G1FEPD](#) 4GB High Performance eMMC NAND Flash Memory
 - Qualcomm Atheros [QCA6234](#) Integrated Dual-Band 2x2 802.11n + Bluetooth 4.0 SiP
 - Texas Instruments [TPS65910A1](#) Integrated Power Management IC
 - Texas Instruments DAC

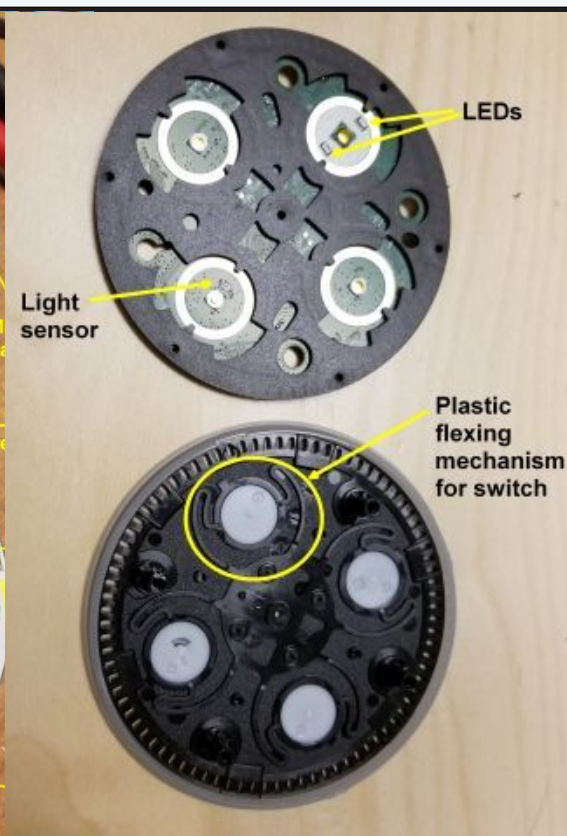
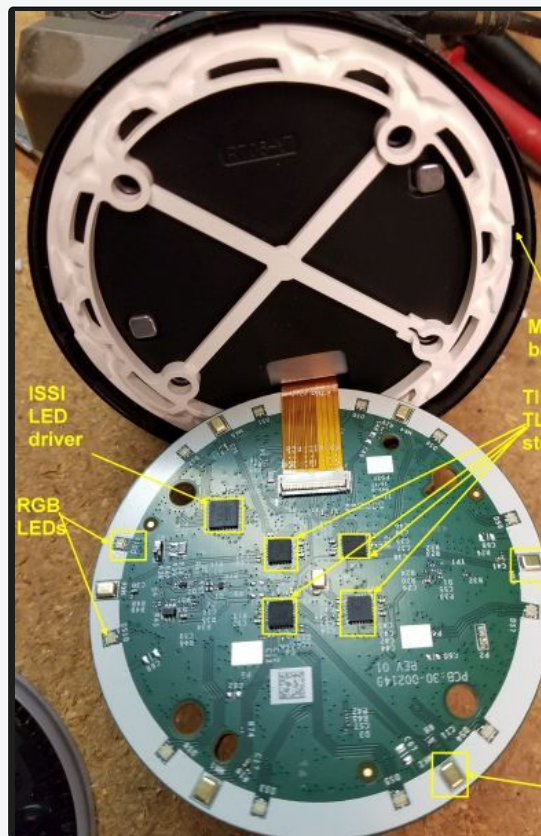
Conflict Minerals Report

For 2017, we have completed our analysis of the suppliers for Amazon electronic devices, fashion and apparel, and other consumer products that fall within the scope of the applicable rules (collectively, in-scope products). A majority of these suppliers certified that they: did not use gold, tin, tungsten, or tantalum in parts or components for our in-scope products; did not source these minerals from the Democratic Republic of the Congo or an adjoining country, referred to as the DRC region; or sourced these minerals from a certified conflict-free smelter or refiner. The remaining suppliers are still completing investigations of their supply chains. As discussed in the Conclusion, for 2017, we identified no suppliers that were sourcing minerals through a supply chain that benefitted armed groups in the DRC region.

<https://ir.aboutamazon.com/static-files/8f0e9156-532d-4d72-97d2-982a55b97e87>



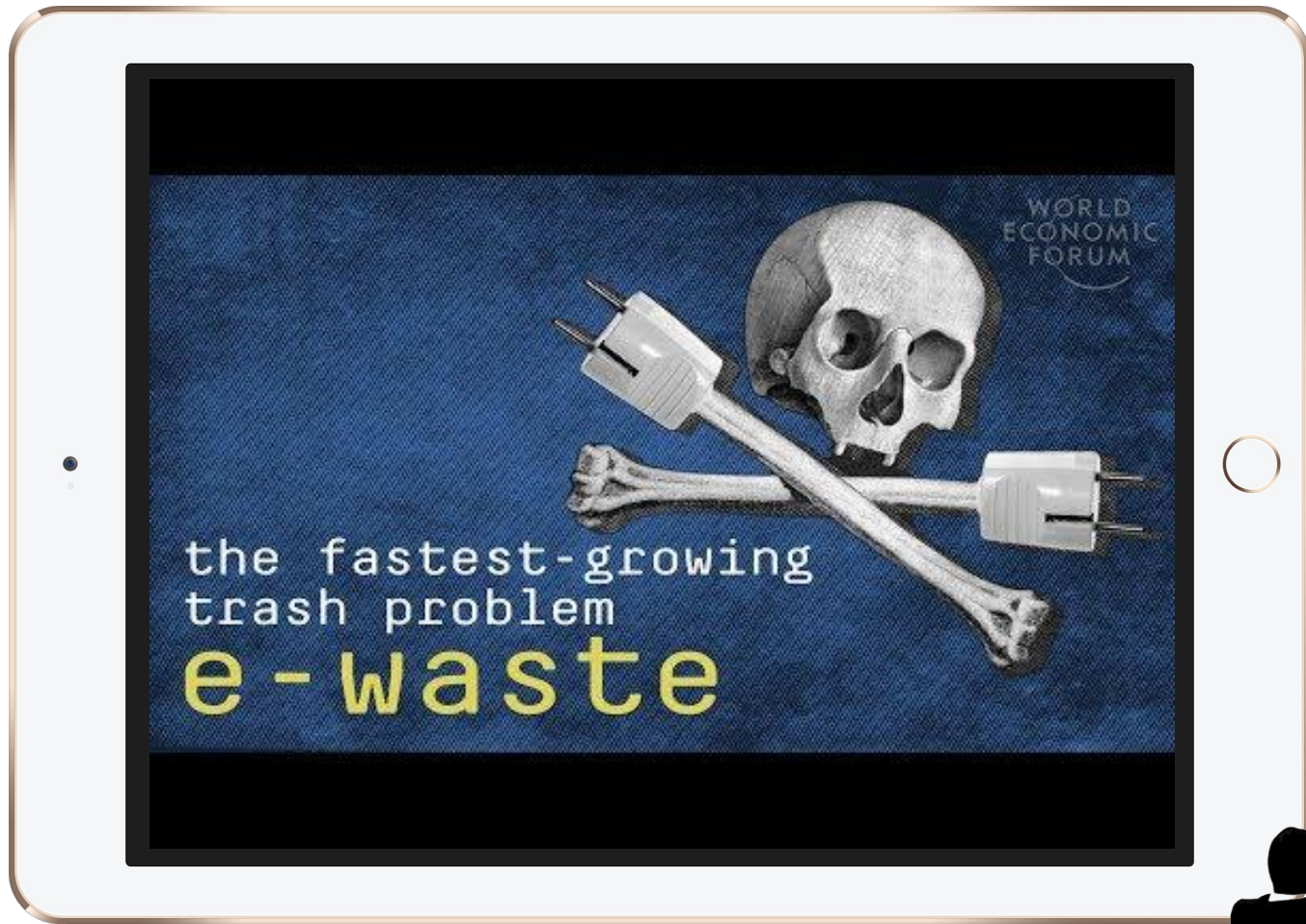




Metals such as arsenic, gallium, indium, and the rare-earth elements (REEs) cerium, europium, gadolinium, lanthanum, terbium, and yttrium are important mineral materials used in LED semiconductor technology. Most of the world's supply of these materials is produced as byproducts from the production of aluminum, copper, lead, and zinc. Most of the rare earths required for LED production in 2011 came from China, and most LED production facilities were located in Asia.

Wilburn, D.R., 2012, Byproduct metals and rare-earth elements used in the production of light-emitting diodes—Overview of principal sources of supply and material requirements for selected markets: U.S. Geological Survey Scientific Investigations Report 2012-5215, 15 p., available only at <http://pubs.usgs.gov/sir/2012/5215/>.



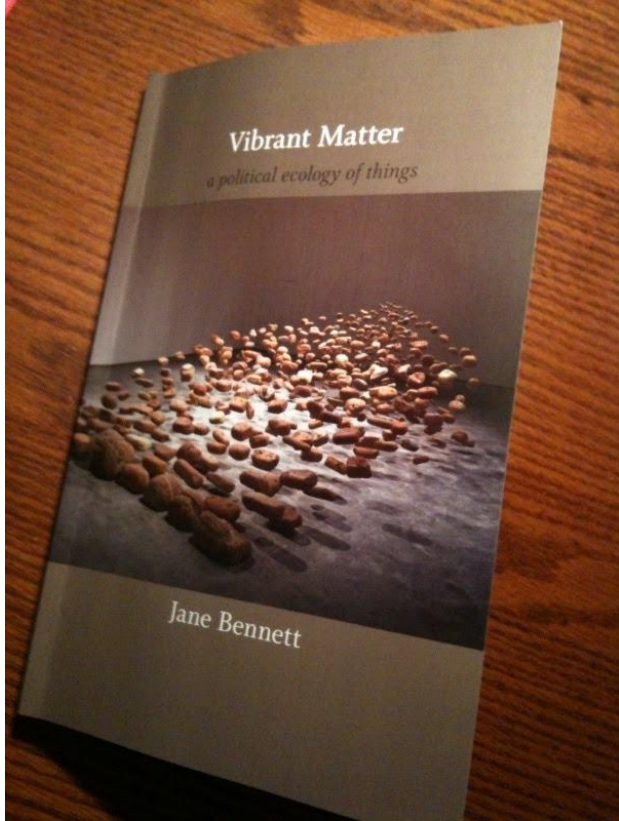




How is hardware an 'object'?

- It exists
- It acts
- It connects
- ... therefore it needs to be looked at





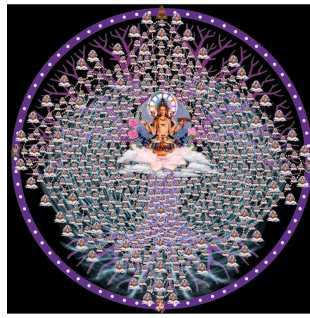
Vitality: “the capacity of things—edibles, commodities, storms, metals—not only to impede or block the will and designs of humans, but also to act as quasi agents or forces with trajectories, propensities, or tendencies of their own. My aspiration is to articulate a vibrant materiality that runs alongside and inside humans to see how analyses of political events might change if we gave the force of things more due” (viii)

— vitality is the beyond-objects of objects themselves, when they become ‘things’ with ‘thing-power:’ “the curious ability of inanimate things to animate, to act, to produce effects dramatic and subtle” (6).

<https://cultivatingalternatives.com/2013/11/28/summary-vibrant-matter-by-jane-bennett/>



LCCMAd



Software/Protocols



Hardware



Humans/Culture



Structure

Flat Ontology

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Any questions?



CHRIS KOHLER CULTURE 03.13.09 12:26 PM

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<CITE>RACING THE BEAM</CITE>: HOW ATARI 2600'S CRAZY HARDWARE CHANGED GAME DESIGN



MOST POPULAR



SECURITY
Google Takes Its First Steps
Toward Killing the URL
LILY HAY NEWMAN



BACKCHANNEL
Paul Le Roux, the Coder
Who Became a Criminal
Mastermind
EVAN RATLIFF



SECURITY
Apple Takes Drastic
Measures to Stop a Nascent
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